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Jessup et al.

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(54) **APPARATUS FOR NON-CONTACT CLEANING A PAINT SPRAY TIP**

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(51) **Int. Cl.**

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B08B 3/02	(2006.01)
B08B 3/08	(2006.01)
B08B 3/10	(2006.01)
B05B 7/02	(2006.01)
B05B 7/16	(2006.01)

(52) **U.S. Cl.**

CPC ***B05B 15/0258*** (2013.01); ***B05B 7/02*** (2013.01); ***B05B 7/1673*** (2013.01); ***B08B 3/02*** (2013.01)

(58) **Field of Classification Search**

CPC B05B 7/02; B05B 15/025; B05B 15/0258; B08B 3/006; B08B 3/02; B08B 3/08; B08B 3/10; B44D 3/006

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,682,273	A *	6/1954	Roach	134/102.1
4,025,363	A *	5/1977	De Santis	134/102.2
4,785,836	A *	11/1988	Yamamoto	134/56 R
4,827,955	A *	5/1989	Stern	134/99.1
4,977,911	A *	12/1990	Vetter et al.	134/34
5,174,317	A *	12/1992	Robb et al.	134/166 C
5,183,066	A *	2/1993	Hethcoat	134/54
6,355,114	B1 *	3/2002	White et al.	134/34
7,467,634	B2	12/2008	Jessup et al.	

* cited by examiner

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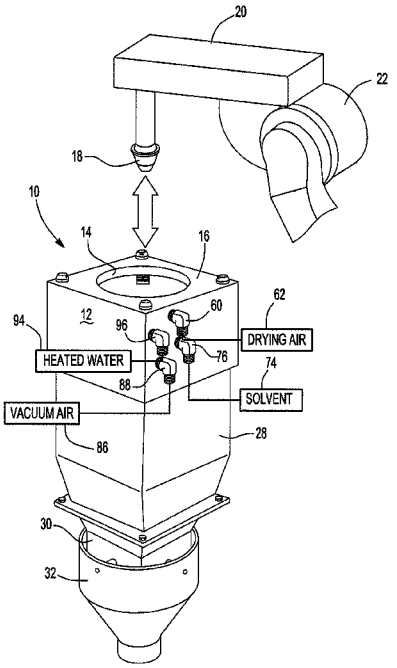
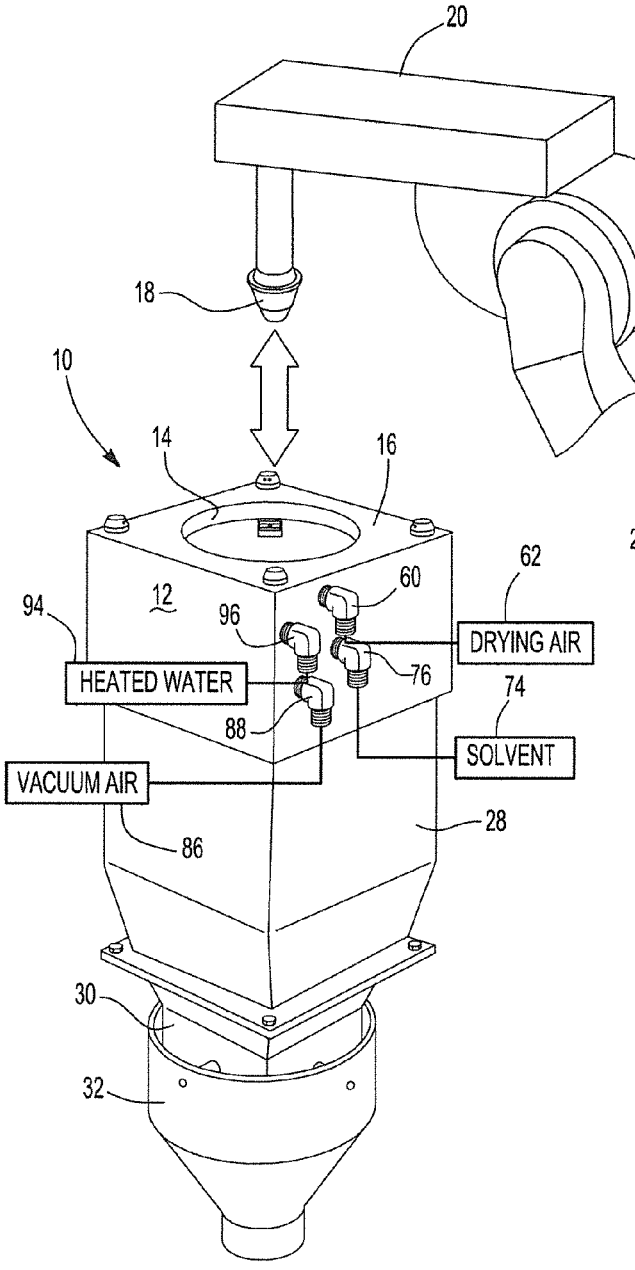
(57) **ABSTRACT**

An apparatus for non-contact cleaning a paint spray tip of a spray gun. The apparatus includes a housing with a top and an opening formed in the top to receive the spray tip. At least one drier nozzle is fluidly connected to a source of compressed air so that discharge from the nozzle impinges upon and dries the spray tip. Similarly, at least one solvent nozzle is also attached to the housing around the opening and discharges solvent on the spray tip when positioned in the housing opening. One or more down flow nozzles are also mounted to the housing to create a downdraft through the housing opening to facilitate cleaning and drying of the spray gun spray tip. A heated fluid also flows through the housing in close proximity to the fluid passageways for the drier nozzle and solvent nozzle in order to heat both the drier nozzle air flow and solvent flow to facilitate cleaning of the spray tip.

13 Claims, 4 Drawing Sheets

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22
18
10
14
16
12
94
96
60
62
DRYING AIR
HEATED WATER
76
74
88
SOLVENT
VACUUM AIR
86
28
30
32

Fig-1

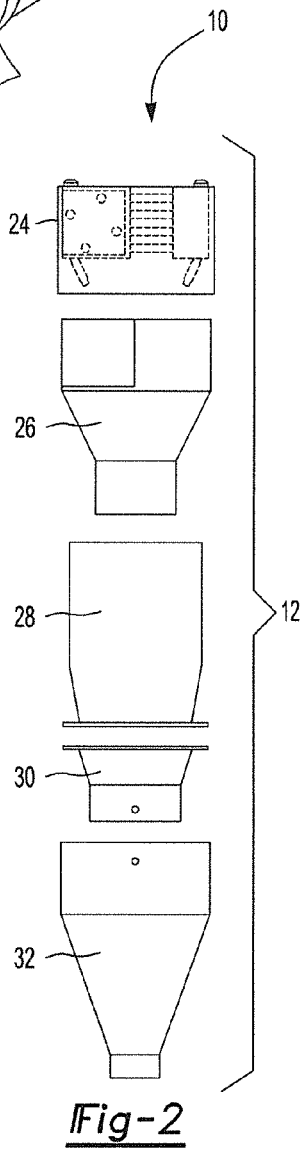
10
24
26
28
30
32
12

Fig-2

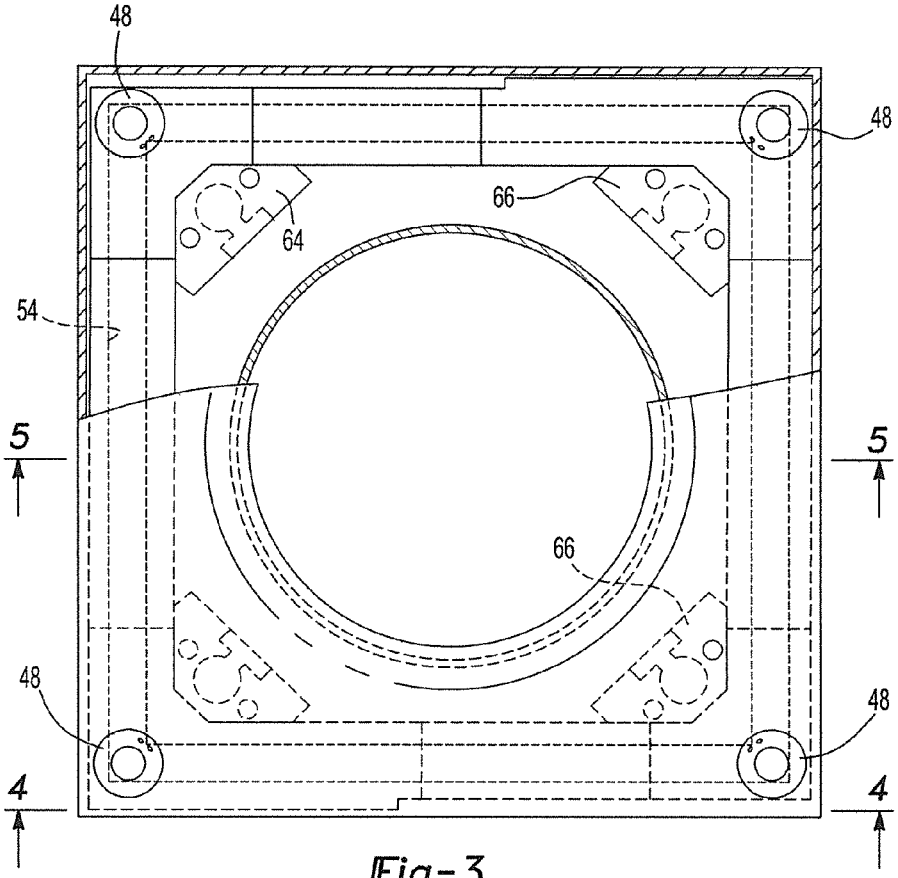

Fig-3

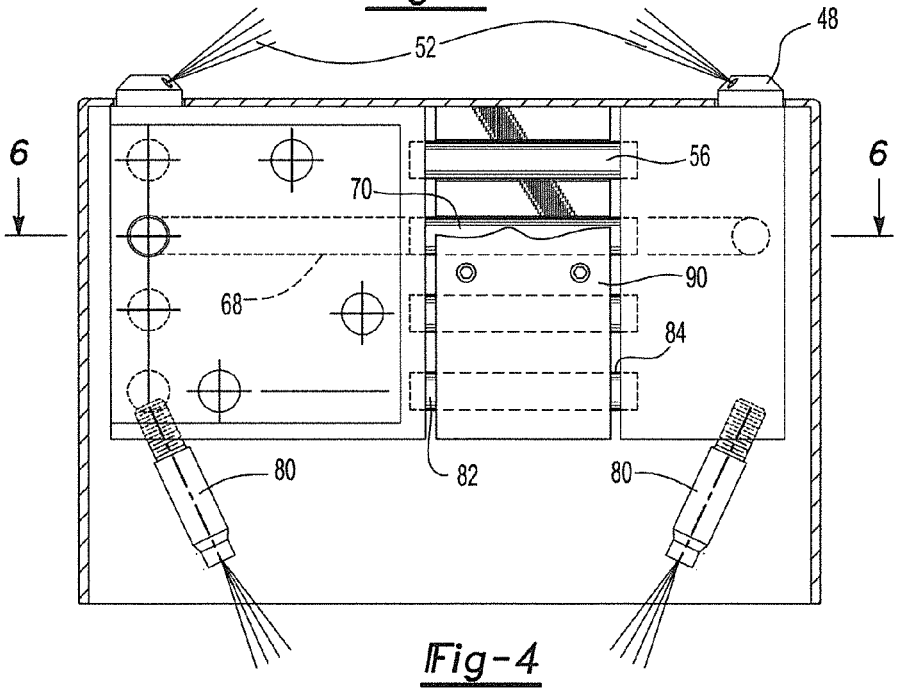

Fig-4

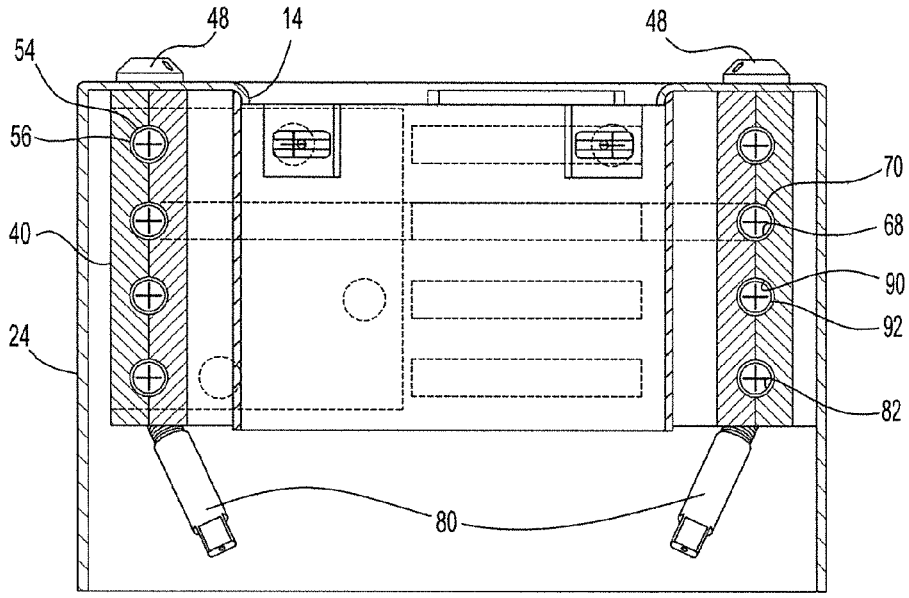
48
14
48
54
56
70
68
40
90
92
24
82
80

Fig-5

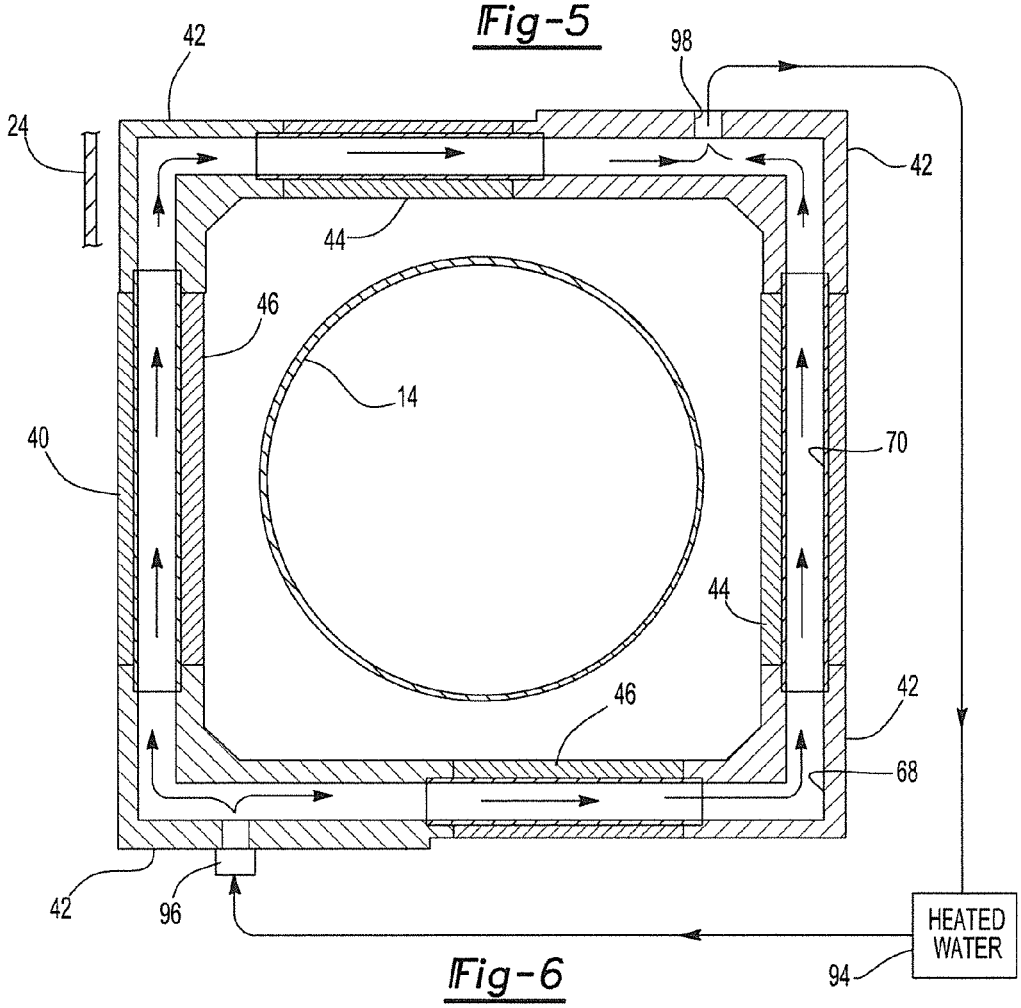
42
98
24
42
44
46
14
40
70
44
46
42
68
42
96
HEATED WATER
94

Fig-6

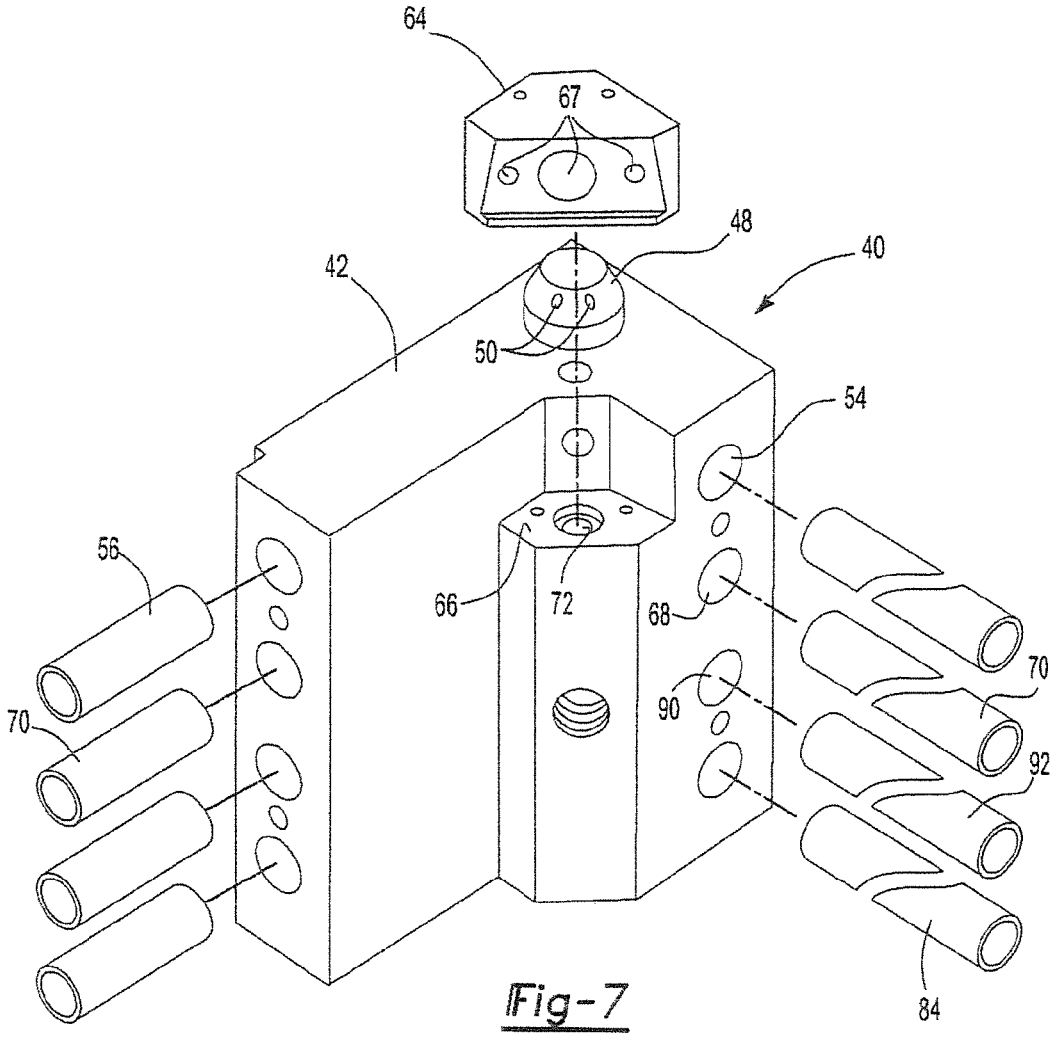

Fig-7

APPARATUS FOR NON-CONTACT CLEANING A PAINT SPRAY TIP

BACKGROUND OF THE INVENTION

I. Field of the Invention

The present invention relates generally to cleaning devices and, more particularly, to a cleaning device for cleaning the paint spray tip of a spray gun.

II. Description of Related Art

Industrial spray painting equipment is widely used throughout the industry in many different applications. For example, robots manipulate paint spray guns in the automotive industry in order to paint automotive vehicles as well as components for those vehicles.

In many applications it is desirable, indeed oftentimes required, to clean the spray tip of the paint sprayer between spraying operations. Otherwise, accumulated paint on the spray tip for the paint sprayers can result in paint drip, uneven paint spray, as well as other aesthetic defects. When this happens, it is oftentimes necessary to completely remove the paint sprayed on the article and then repaint the article. This, however, is costly and time consuming.

There have, however, been previously known devices for cleaning the spray tips of paint sprayers of the type manipulated by robots. For example, U.S. Pat. No. 7,467,634 to Jessup, entitled "No Contact Spray Apparatus Cleaning Device", discloses a non-contact device for cleaning the spray tip of a robotic paint sprayer. In this previously known device, the paint spray tip is inserted through an opening in the top of a housing and sprayed with a solvent for the paint. After spraying, drier air is discharged on the paint spray tip in order to dry the paint spray tip. In addition, downdraft nozzles contained within the housing create a downdraft or a partial vacuum within the housing to draw air flow down through the opening in the top of the housing and across the paint spray tip.

These previously known devices for non-contact cleaning the paint spray tip of a spray gun have proven entirely adequate when used with solvent-based paints. For such solvent-based paints, the drier air flow has proven more than satisfactory for completely drying the paint spray tip after cleaning by the solvent.

However, due to government regulations as well as other concerns, many industries have shifted from solvent-based paints to water-based paints. With these previously known devices for non-contact cleaning of the paint spray tip of the spray gun, the spray tips are oftentimes not adequately dried upon removal from the device. While adequate drying of the paint spray tip may be achieved by increasing the cycle time for the non-contact cleaning device, such increased cycle time unacceptably increases the cycle time of the overall painting operation. This, in turn, increases the overall cost of the painting operation.

SUMMARY OF THE PRESENT INVENTION

The present invention provides an apparatus for non-contact cleaning of a paint spray tip of a spray gun which overcomes the above-mentioned disadvantages of the previously known devices.

In brief, the apparatus of the present invention comprises a housing having a top and an opening in the top dimensioned to receive the spray tip so that the spray tip does not contact the housing. Typically, the spray tip is mounted on a spray gun manipulated by a robot.

At least one drier nozzle is attached to the housing so that a discharge from the drier nozzle impinges against the spray tip as the spray tip is withdrawn from the housing. Preferably, a plurality of drier nozzles are placed at circumferentially spaced positions around the housing opening so that air from the drier nozzles impinges against all sides of the spray tip.

At least one, and preferably several circumferentially spaced solvent nozzles are also mounted in the housing and are oriented to discharge solvent on the spray tip once the spray tip is positioned in the housing opening. The solvent nozzle is connected to a solvent passageway formed through the housing and then to a source of pressurized solvent. The actual solvent will, of course, depend upon the type of paint that is sprayed by the spray gun.

The housing also includes a heater fluid passageway in close proximity to the solvent passageway as well as the drier air passageway. Preferably, all passageways extend through one or more heat sinks within the housing. Thus, the heat from the heated water flowing through the housing simultaneously heats both the drier air as well as the solvent. This, in turn, facilitates faster and complete drying of the spray tip following a cleaning operation, particularly in the case where the paint is a water-based paint.

At least one down flow nozzle is positioned beneath the housing opening and is oriented in a direction away from the housing opening. The flow of compressed air through the down flow nozzles effectively creates a lowered pressure region below the housing opening thus drawing air from the drier nozzles downwardly through the housing and across the spray tip.

BRIEF DESCRIPTION OF THE DRAWING

A better understanding of the present invention will be had upon reference to the following detailed description when read in conjunction with the accompanying drawing, wherein like reference characters refer to like parts throughout the several views, and in which:

FIG. **1** is a fragmentary elevational view illustrating a preferred embodiment of the present invention;

FIG. **2** is a side exploded view illustrating the preferred embodiment of the present invention;

FIG. **3** is a top plan view of the present invention;

FIG. **4** is a view taken substantially along line **4-4** in FIG. **3** and with parts removed for clarity;

FIG. **5** is a view taken substantially along line **5-5** in FIG. **3**;

FIG. **6** is a sectional view taken substantially along line **6-6** in FIGS. **4**; and

FIG. **7** is a fragmentary elevational and exploded view of a portion of the preferred embodiment of the present invention.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT OF THE PRESENT INVENTION

With reference first to FIGS. **1** and **2**, a preferred embodiment of a non-contact cleaning apparatus **10** according to the present invention is shown. The apparatus **10** includes a housing **12** which is constructed from any appropriate material, such as sheet metal. The housing **12** includes a generally circular opening **14** in its top **16**. This opening **14**, furthermore, is dimensioned to receive a spray tip **18** of a paint spray gun **20**, typically manipulated by a robot **22** (only partially illustrated).

Still referring to FIGS. **1** and **2**, the housing **12** preferably includes a plurality of housing sections, including a top section **24** as well as lower housing sections **26**, **28**, **30**, and **32**.

These housing sections **24-32** are secured together in any appropriate fashion, such as by bolts. In addition, the housing sections **24-32** all include a vertically open passageway so that the solvent may be collected and recycled or disposed of. The air flows through the opening **14** in the top housing section **24**, through the housing sections **32**, and out through a baffle between housing sections **30** and **32**.

With reference now to FIGS. **5-7**, a heat sink **40** is contained within the housing upper section **24** so that the heat sink **40** extends entirely around the opening **14**. Although the heat sink. **40** is illustrated in the drawing as substantially rectangular in cross-sectional shape (see FIG. **5**), the heat sink may be of any appropriate shape surrounding the opening **14** without deviation from the scope or spirit of the invention. Furthermore, the heat sink **40** is constructed from a material, such as metal, with high thermal conductivity. In the preferred embodiment, the heat sink is constructed from aluminum.

As best shown in FIGS. **6** and **7**, the heat sink **40** preferably includes a corner section **42** at each of the four corners of the housing upper section **24**. Linear sections **44** and **46** of the heat sink **40** (FIG. **6**) extend between and connect the corner sections **42** of the heat sink **40** together.

As best shown in FIGS. **4** and **7**, an air drier nozzle **48** is attached to at least one, and preferably all four of the corner sections **42** of the heat sink. The air drier nozzles **48** include openings **50** (FIG. **7**) which, when connected to a source **62** of pressurized air, discharge air toward the center and above of the housing opening **14** as shown at **52**. Consequently, as a spray tip **18** (FIG. **1**) is withdrawn from the housing opening **14** following a cleaning operation, the flow of pressurized air through the nozzles **48** will impinge upon and dry the spray tip **18**.

As best shown in FIGS. **3** and **5**, a drier air passageway **54** is formed through the heat sink **40** entirely around the heat sink **40**. This drier air passageway **54** may be formed, for example, by tubes **56** (FIGS. **5** and **7**) which extend through bores in the heat sink **40**. These tubes **56**, furthermore, are also constructed of a heat conductive material, such as metal, so that heat may flow by conduction from the heat sink **40** and to the drier air supply tubes **56**. Furthermore, a drier air inlet **60** (FIG. **1**) is open exteriorly of the housing **12** and fluidly connects the drier air passageway **54** to the source **62** of pressurized air.

With reference now to FIGS. **3**, **5**, and **7**, at least one, and preferably a plurality of solvent nozzles **64** are mounted within the housing **12** around the housing opening **14**. Preferably, each solvent nozzle **64** is mounted to a flat **66** formed in each corner section **42** of the heat sink **40**. Each solvent nozzle **64** includes one or more discharge ports **67** which are oriented so that, when connected to a source **74** (FIG. **1**) of pressurized solvent, sprays the solvent towards the center of the housing opening and thus against the nozzle tip **18** when positioned within the nozzle opening.

A solvent passageway **90** is formed within the heat sink **40**. Furthermore, a tube **92** constructed of a material having high thermal conductivity is preferably positioned within the heat sink **40** to fluidly connect the solvent passageway **90** to the solvent nozzles **64** through an opening **72** in each heat sink corner ledge **66**.

With reference now to FIG. **1**, the solvent passageway **90** is fluidly connected to the source **74** of solvent through a fluid fitting **76** open exteriorly of the housing **12**. The actual type of solvent will, of course, vary depending upon the type of paint. For example, for water-based paints, the solvent typically comprises water.

Referring now to FIG. **4**, at least one, and preferably four circumferentially spaced down flow nozzles **80** are mounted to the housing **12** and positioned around and below the housing opening **14**. These down flow nozzles **80**, as best shown in FIG. **4**, are directed downwardly and away from the housing opening **14**. A down flow air passageway **82** extends through the heat sink **40** and is fluidly connected to each down flow nozzle **80**. Tubes **84** having high thermal conductivity extend through the heat sink **40** to form the down flow fluid passageway which interconnects the down flow nozzles **80** together. This fluid passageway, furthermore, is connected to a source **86** (FIG. **1**) of pressurized air through a fluid connector **88** accessible exteriorly of the housing **12**.

In operation, upon connection of the down flow nozzles **80** to the source **82** of pressurized air, pressurized air is expelled from the nozzles **80** downwardly and below the opening **14** in the housing **12**. This, in turn, creates a partial vacuum below the housing opening **14** which serves to induct air flow from the air drier nozzles **48** down through the housing opening **14** and across the spray tip **18** when positioned within the housing opening **14**.

With reference now to FIGS. **5**, **6**, and **7**, a heated fluid passageway **68** is formed through the heat sink **40** and this passageway may include one or more tubes **70** constructed of a high thermally conductive material, such as metal. The heated fluid passageway **68** is then fluidly coupled to a source **94** (FIG. **1**) of heated fluid, preferably water, through a fluid connector **96**. Consequently, as best shown in FIG. **6**, heated fluid flows through the fluid coupling **96** and into the passageway **68**. The heated fluid then flows around the heat sink **40** and out through an outlet **98**. Since the heated fluid which flows through the heated fluid passageway **68** is uncontaminated, the outlet **98** is preferably connected back to the source **94** of heated fluid for subsequent recirculation through the heated fluid passageway **68**.

The heated fluid passageway **68** is in close proximity to both the drier air passageway **54** as well as the solvent passageway **90**. Consequently, since the heated fluid passageway **68** is thermally coupled to both the drier air passageway **54** and the solvent passageway **90** by the heat sink **40**, the hot fluid flow through the heated fluid passageway **68** effectively heats both the drier air in drier air passageway **54** as well as the solvent in solvent passageway **90** prior to their respective discharge against the spray tip.

In operation, during a cleaning operation a spray tip **18**, following a paint spraying operation, is inserted through the housing opening **14** and into the interior of the housing. Upon insertion, spray from the solvent nozzles **64** impinges upon and washes the paint from the spray tip. Simultaneously, air spray from the air drier nozzles **48** is inducted by the partial vacuum created by the downdraft nozzles **80** so that the air flows downwardly and across spray tip **18** thus drying the spray tip **18**. Furthermore, as the spray tip **18** is withdrawn from the housing opening **14**, the continued air flow from the air drier nozzles **48** completely dries the spray tip **18** in the desired fashion.

A primary advantage of the present invention is that the flow of the heated water through the heater fluid passageway heats both the drier air as well as the solvent. This, in turn, speeds the drying of the solvent from the spray tip **18** to a short time period in preparation for the next spraying operation. The short time period for cleaning and drying the spray tip **18** shortens, and thus enhances, the overall cycle time of the cleaning apparatus **10** of the present invention.

From the foregoing, it can be seen that the present invention provides an effective non-contact cleaning apparatus for a paint spray tip of a spray gun. Having described my invention, however, many modifications thereto will become apparent to those skilled in the art to which it pertains without

deviation from the spirit of the invention as defined by the scope of the appended claims.

I claim:

1. A non-contact apparatus for cleaning a paint spray tip of a spray gun comprising:

a housing having a top and an opening in said top dimensioned to receive the spray tip such that the spray tip does not contact said housing,

at least one drier nozzle attached to said housing so that a discharge from said at least one drier nozzle impinges the spray tip, said at least one drier nozzle fluidly connected through an air supply passageway to a source of pressurized air,

at least one solvent nozzle attached to said housing and oriented to discharge solvent on the spray tip when positioned in said housing opening, said solvent nozzle fluidly connected through a solvent passageway to a source of solvent,

at least one down flow nozzle adapted for connection with a source of pressurized air, said at least one down flow nozzle positioned in said housing at a position spaced from said top of said housing and oriented to discharge air in a direction away from said housing opening,

said housing having a heater fluid passageway in close proximity to said solvent passageway and said air supply passageway, said heater fluid passageway fluidly connected to a source of heated fluid.

2. The apparatus as defined in claim **1** wherein said heated fluid comprises water.

3. The apparatus as defined in claim **1** wherein said solvent passageway and said heater fluid passageway extend through a housing portion constructed of a material with high thermal conductivity.

4. The apparatus as defined in claim **3** wherein said air supply passageway extends through said housing portion.

5. The apparatus as defined in claim **3** wherein said material with high thermal conductivity comprises metal.

6. The apparatus as defined in claim **5** wherein said metal comprises aluminum.

7. The apparatus as defined in claim **1** wherein said heater fluid passageway extends substantially entirely around said housing opening.

8. The apparatus as defined in claim **1** wherein said at least one solvent nozzle comprises a plurality of solvent nozzles spaced around said housing opening.

9. The apparatus as defined in claim **8** wherein said plurality of solvent nozzles comprises four solvent nozzles.

10. The apparatus as defined in claim **1** and comprising a heat sink disposed around said opening, said heater fluid passageway extending through said heat sink.

11. The apparatus as defined in claim **10** wherein said solvent passageway extends through said heat sink.

12. The apparatus as defined in claim **10** wherein said air supply passageway extends through said heat sink.

13. The apparatus as defined in claim **1** wherein said at least one down flow nozzle comprises a plurality of spaced apart down flow nozzles.

* * * * *